NERRS Science Collaborative
Sustainable Shorelines for the Hudson River
Teleconference October 23, 2012, 1- 2:30 pm ET
Presenters: Betsy Blair, Hudson River NERR, and Ona Ferguson, CBI
Facilitator: Dolores Leonard, Science Collaborative

Dolores: For those of you who don't know me, my name is Dolores Leonard, and I work with the NERRS Science Collaborative, which is sponsoring this event. The NERRS Science Collaborative is a competitive funding program that funds collaborative research that brings intended users of science into the scientific process. All of the projects we fund are focused on issues and problems that are priorities for Reserve sites. We exist through a cooperative agreement between NOAA and the University of New Hampshire (UNH).

The project we're going to focus on that Betsy and Ona are going to be talking about is the "Sustainable Shorelines for the Hudson River" project, which is led by the Hudson River NERR, and is a multi-disciplinary trans-organizational project that's providing information about the physical forces shaping Hudson River shores, the ecological impact of different constructed shorelines, and the performance of innovative shoreline stabilization structures.

Today Ona and Betsy are going to give you an overview of that very complex, interesting project, and they'll dig in a little bit to each component of the project—how, for example, the team has been characterizing the Hudson River's current, future physical and ecological conditions, how they're comparing the cost and effectiveness of different shoreline management options, and generally how the team is working with stakeholders to advance ecologically the shorelines along the Hudson River Estuary.

They were able to hit the ground running. Even though they have another year to go on their project, they've already generated a treasure trove of papers and reports and other kinds of tools that I encourage all of you to check out if you have not already. You'll find them online on the project's website, and I can give you that link after this teleconference to make sure

you have it (www.hrnerr.org/hudson-river-sustainable-shorelines). It's full of good information. I also encourage you, if you enjoy learning about this project today, and you want to hear more about Science Collaborative sponsored projects at other Reserves, check out nerrs.noaa.gov/sciencecollaborative.aspx, and on our sponsored projects page, if you find a project you're burning to know more about, send me an email or give me a call, and I'm happy to work with those investigators about figuring out how to do a webinar, or a phone conference like this, or something else to create access to that work.

I'd like to introduce our presenters. Betsy Blair is the manager of the Hudson River NERR, and lead on the project. She's managed the HRNERR since 1985. She's overseen a variety of other NY state departments of environmental conservation habitat programs, on the Hudson and on Long Island Sound, including those focused on habitat restoration, submerged aquatic vegetation, river bottom mapping, and many others. She also has experience working on resource policy issues, including wetland mapping, ecosystem research, and Betsy has been a foreign fisheries observer in the Bering Sea. Thank you, Betsy, for being here today.

Ona Ferguson is a senior associate at the Consensus Building Institute which is a not-for-profit organization in Massachusetts, and provides mediation and dispute systems designed for public and private clients around the world. Ona is a facilitator, mediator, trainer, and helps groups work constructively together on natural resource and public policy issues that have included land use, climate change, coastal and estuarine management, superfund sites and organizational and strategic planning. These are issues near and dear to the NERRS. Some of her recent projects have included co-facilitating the Cambridge Climate Congress and dialogue among city leadership and citizens, and designing and co-leading a two-day federal policy dialogue on adaptive management and marine renewal energy. Before Ona joined the sustainable shorelines project a few years ago, she knew little about the NERRS and its mission, and today she's verging on being a NERRS organizational expert, because she's working with four Science Collaborative sponsored projects, connected to all of the New England Reserve sites, and Old Woman Creek site in Ohio. Welcome, Ona.

My name is Dolores Leonard and my role is support transfer for the projects that we fund. What we mean by transfer is sharing information as effectively as we can about these projects with our colleagues in the NERRS.

I'll now turn the presentation over to Betsy, and ask that you advance to the next slide in your pdf. (5:42)

Betsy: Hi everyone. I feel like I'm talking to the extended family, and I'm glad you've all joined from a broad range of sites. From the survey information at registration, I see at least six of you are working on shoreline issues yourselves, and we'd love to hear about your projects as well.

This project had its origins around 2006 when we started understanding what the projections might be for the Hudson River, which is tidal from New York City up 150 miles. We started thinking, given our fairly steep landscape in most places, what did that mean for wetlands survival. Having put 25 years plus thinking about near shore habitats and how to conserve and preserve them, it was a staggering thought that we could lose them. I started thinking about shorelines as the gateway potentially in the future, and also shorelines as habitats in and of themselves. What if we did lose a significant percentage of those wetlands, how could we maximize available habitat? Thinking about shorelines in a big way, trying to map them, trying to understand them. That's where this began.

Go to the next slide. You'll see that this is very much a work in progress. I don't expect to leave this topic for the rest of my career. For this particular project we're in about year 4, and we're still analyzing data collected, and we plan to have one or two more years working with Science Collaborative funding, to bring this part of the project to fruition.

Next slide. Our plan for today is to have 4 sections in this webinar. I'll give you a quick introduction. Ona will talk about the project organization and our collaborative piece. Then back to me for some of the findings and studies to date, then over to Ona again for how we're advancing adoption of our findings.

Next slide. The satellite image shows parts of New York and Connecticut. At the bottom is Long Island. To the left corner is New York City. And the Hudson is tidal all the way up. Where a large river comes in from the west, that's the Mohawk River. Just south of that, 150 miles, half of it is reliably fresh water.

Next slide brings you in a little closer. Very hard shoreline. Our project is just beginning to work its way into New York City. You're dealing with a much more unrelenting vertical, more urban shoreline situation. Try to be very creative about building habitat back in and resilience.

Continuing on, as you moved up the river, there is a whole string of small to medium river towns. This is my town, Kingston, N.Y., about 100 miles north. A lot of them have beautiful waterfronts with public access. A lot of them are still recovering from industrialization and decay. There are a lot of opportunities there about decisions being made on those shorelines.

Continue down to the next slide (page 8). We have a range of different slope areas. We have very gradual shore areas. Then continuing on to more steep ones, where the Appalachians cross the Hudson. There's the Hudson Highlands and the Bear Mountain Bridge, with the Reserve site in the foreground—Iona Island, one of our four.

Next slide. Of course we have industrial and commercial waterfront in varying stages of decay and use.

Then all together on slide 10, from about 25 miles north of New York City (NYC) all the way up to the federal dam in Troy, we've inventoried these shorelines, and find that we have not quite half of it "natural" (somewhat altered over time, but in the Hudson this is what counts as natural). Nearly half are engineered. More of it is engineered, the closer to NYC. Then we have a category called remnant engineering, which are engineered shorelines that have broken down so much that they're verging on natural again.

Next slide. I wanted to make the point that although the project is called "Sustainable Shorelines," it's really a broader zone from an ecological

standpoint and from a human use standpoint, so the shore zone could extend off into the water a bit, from the blkhd on the right, and can extend onto the outlet just beyond the shoreline. Things move along these shorelines and from dry to wet, and wet to dry. It's important to keep that concept in mind.

Next slide. We use the term Sustainable Shorelines, and it means different things to different people. Emilie Hauser on the Reserve staff spent some time compiling definitions of different terms so that we as a team as a region could use one set of definitions and common terminology. It's on our website and may be useful to you as a model, or as a starting point to developing your own regional terminology. What we mean by this in the context of this project are shorelines that are adaptable to climate change and also ecologically enhanced in some way. In particular, there are soft and hard shorelines. We realize we're going to need hard shorelines, but we want to find ways to spread the gospel that we can have hard shorelines and have them ecologically enhanced.

Next slide. The folks that we're targeting this work towards include a range of people—folks making policy decisions around, for example, what FEMA funds and what it doesn't in reconstruction of shorelines. Will it fund, for example, plantings. Right now, in our part of the world it does not. We're trying to find ways to infiltrate that policy. The bottom photo is of a group planting shorelines in NYC that includes architects and landscape architects, community activists, and others. We're targeting the work towards engineers and landscape architects. We have some of those folks on our Advisory Committee (AC) and they're resource managers and advocates, managing public or private land. It's a broad group and we're recognizing there are differences, and trying to target our studies and findings selectively to each group.

Next slide. Questions?
Jaime Kooser: When you say 'scope' what are you focusing on in the present in terms of the geographic range. Is it from NYC to Troy?
Betsy: Right now we're focused on the Tappan Zee Bridge to the Troy dam, so the upper 125 miles of the estuary. However, we've been talking to folks in NYC over the last year or so about their issues and concerns. We just

received some funding to design innovative shorelines and we have a project going forward in NYC.

A word about Ona. We were advised that we needed to find someone to work with us who could be a neutral entity, and we found Ona and Pat Field at CBI. They have become integral to our organization. More than a meeting facilitator or note taker, they are part of the brain trust shaping and moving the project forward. That's a project role I failed to realize how important it was in helping to evolve the project in meaningful ways.

Page 17/ Project Organization. (20:00) I'll go briefly through how we organize our work, first how we organize the different groups of people we're working with to make this happen, and second how we organize the process of all the different research pieces.

Project Structure slide. There is a team of three of us—Betsy, myself, and Emilie Hauser—who try to keep everything moving forward. We then have a coordinating team made up of all the primary researchers—engineers, ecologists, and a few others—who are involved in the related work. The coordinating team talks once a month for an hour and a half and meets once or twice a year for a whole day in person, as well as attending any bigger meetings that we have. Those are the essential people on the project.

We then have an Advisory Committee in addition to our coordinating team, which is about 35 people, the number is slowly growing, and that group has met 4 times during 2-1/2 years. They meet for a full day. That group is comprised of representatives of the different users that Betsy was talking about. People we hope will take our results and make changes on the way they do things based on what we are learning. That group tends to show up, and is interested and engaged, and they, along with the coordinating team, are the big pool of people who know what's going on with the project. We rely on these people when we need guidance. The 8 of us in the top couple of groups can't do everything. We need other people helping. The AC, based on their expertise, helps at different times.

Next slide: Related teams and efforts. (22:49) This was an early effort to imagine visually all the different pieces that we had, the different groups we were working with, and the different subjects we were working on. We've had numerous versions of graphics like this. The box on the bottom shows the related initiatives by colleagues in different agencies in N.Y. State, advocacy groups, and others that we've made sure to coordinate with. Often people in our coordinating team or on our Advisory Committee are involved in those initiatives, and we want to be sure we're not duplicating.

Next page there's a photograph that's our Advisory Committee. We take a picture every time we meet so we remember what we've done and the faces. That's the structure of how we keep organized. For the first year and a half we did have a fourth group—a project team which was the more technical members of our Advisory Committee. After a while we decided we could merge our Advisory Committee and our technical team, so they're one and the same.

Going to the research approach slide. It's become clear over the last 2-1/2 to 3 years that we have a standard approach to assigning tasks, scoping out work, getting the work done, and getting it wrapped up, so it becomes good quality work and connected to the whole project. These are the steps we use:

1. First we do some pretty involved scoping with the coordinating team about what we're trying to learn.
2. We often have subcontractors do some research to find out what's been done before, how would it fit, what needs to get done, and how would it get done if we were going to do new, more thorough research.
3. The research gets done
4. Then at about 80% completion of the contractor's time, they submit a draft report or product to our coordinating team, and we have a small group of coordinating team members and potentially AC members or others who look at the results, and see if the quality is right.
5. We've had occasion when some things had to be better fact checked, or more work needed to be done, and this is the place

where that happens. The person doing the research revises the results and prepares a document, which can be very large. We ask the researchers to synthesize their findings and essential messages into 2-4 pages that a layperson can read.

6. Step 6 is sharing with our AC, but also if the work is peer reviewed and publishable, getting it into peer reviewed journals, presenting at conferences, and the like.

Next slide is the coordination piece – juggling (26:54). It's extremely complex. It's tempting to think if we have 8 things going on at the same time, we can do things more efficiently. In fact, it takes more time than if those 8 things were done independently. The results need to be translated and communicated about what's been learned and connecting it to the project as a whole. Betsy will talk more about that.

The flip chart (next slide) that says "Timeline for Action" is to note that we've asked people who help us, have their own near-term timeline at any one point. One big lesson is to manage quality in an area of expertise that we don't have can be difficult. For example, we don't have an economist, but we had aspirations of learning things related to cost and economics and that's been a challenge for us, which we've addressed in a few different ways.

Questions about project organization? How we're structuring ourselves and how we're structuring the steps of our research? (28:34)
Kalle: My question is about your work, Ona, and when you talk with folks at CBI, are there aspects of how large and complex this project is or other unique aspects of it that are worth noting at this time? As a consultant, is this something that you run into a lot, or is it unusual?
Ona: I ran a conference in May for colleagues around the country and one of the big themes was that environmental work right now is more and more complicated and interconnected. I think this project is a perfect example. A lot of projects we work on are a year or two with one or two topics. This organization piece is unique—having to organize all the different sub-pieces by the coordination team.

Page 26. Back to Betsy. I'll be talking about studies and findings to date.

In order to understand what kind of shoreline treatments can be sustainable, we have to better understand current conditions, and what the predictions are for future conditions. Secondly we've been looking a lot at what our shoreline management options appear to be.

Page 27. Let me begin with current and future conditions. Although the satellite photo showed a long thin sliver of water going up from New York City, it's very different from most if not all of your sites which involve large bodies of water. We do have substantial wakes. We have very large ships going up to Albany that create enormous wakes. And we have ice – a lot of ice. We broke those things apart and we're looking at them as a piece of the work that's being done by a shoreline engineer and a modeler at the Stevens Institute of Technology.

Slide 28 is a picture of the ice on January 20, 2011, outside our office. The Coast Guard has been measuring ice on the river for 11 years, so we have data about the conditions, summarized for 16 different sections of the river. That was put together for probabilities of ice along different parts of the river in terms of both spatial coverage and thickness. Our engineers are interested in that because in the past they haven't been able to model ice or design with any firm ice data in their back pockets. We're trying a couple of different ways of presenting the information or making it available. First we'll put up a map of the Hudson and link to different databases about the ice so folks can simply download information about their parts of the river. The physical data is being collected in two ways, one with actual data, e.g., ice; and…

Slide 29. …a wake study. A lot of Stevens students have spent part of their summer sitting on the banks of the Hudson in a chair with a water bottle next to a stick, like the one pictured on the left, spending 12-14 hours logging wake height and relating it to the ships that pass. That creates a body of data that will help us analyze wake energy at the shorelines.

Next slide. (34:13) This is an image generated by a model at a much, much finer scale than previously existed in modeling currents in the Hudson. Tidal currents and down river currents. It's being done in a two-dimensional way right now, but struggling to get a three-dimensional model to work that will

actually move the water up in time as sea level rises and be able to model how the extra inundation of duly flooded area will change the currents. That's information that helps designers finely pinpoint what kinds of shore structures can stand up to the test of time. That's work that's underway. Lastly in the physical condition section of the study we've taken information…

Slide 31. … that looks at what our projections are for sea level rise, downscale for this part of New York State, and what we're looking at under a rapid ice melt scenario is 41-55 inches of rise by 2080. This is an image of my town, Kingston, flooded at the peak of the Irene flood. Here the water is up about that much. This is our vision of tomorrow. Add to that storms on top of it, these buildings won't be just 6 inches deep in water inside the doors, they'll be 4-5 feet deep with water. Recognizing that and trying to figure that into our calculations, and certainly introduce it into our discussions about how to use the shorelines information in our larger work in trying to help communities adapt to these future conditions in ways that will not jeopardize the natural resources that are associated with the estuary and the shorelines.

Slide 32 (36:57). Our findings—the sea level rise projections; the ice melt rates as far as I've been able to determine are exceeding those projected when the last intergovernmental results came out. We're looking forward to what the next 2013 results will be in terms of that rise. Part of this work happened in the CICEET phase, with separate funding, but someone took a look at the data and confirmed that storm surges do travel to the head of the tide, up 150 miles. Their effect is outdistanced by the effect of the watershed flooding in terms of contributions to the flooding as you get closer to the dams—the upper third, roughly, of the estuary. Storm surge is overtaken by watershed inputs of water. Previously people thought storm surges came in and then petered out somewhere lower down in the estuary. That's become a factor to design for and plan for. (38:31) The ice record has been compiled and is going to be used for shoreline design. And our fine scale wave models are going to be available. We're looking at those to see if we can integrate them and come up with 'magic numbers' for different parts of the shoreline—some kind of integrated figure. We think that's probably unlikely, but we're talking to some engineers about how to

make this information available in a useful way to intended users. Stay tuned for that…

Slide 33 (39:19). In the second part of the results discussion, we've taken a look at shoreline option attributes, looking at trade-offs, or different characteristics of shorelines—ecological benefits, structural stability, and construction and maintenance cost. These don't work uniformly, so there's not one magic bullet that will work in the Hudson. We're keeping a focus on hard shorelines.

Slide 34 (40:10). I want you to know that the "Ten steps to better shore zones" publication exists. Here it's a bit blurry. These findings are a result of a literature review done by Dave Strayer at the Cary Inst of Ecosystem Studies in NY. This goes back to the second step in our research project which tried to understand what's gone before. There's a much longer document available to you that should be relevant to shorelines nationally. I urge you to take a look at that as a foundation document. Here are basic recommendations when you're thinking of doing something to the shoreline—very non-technical. There are more technical studies refining the 10 points that we hope will yield guidance more specifically.

This is happening in two phases. The first was funded under CICEET. Funded by another party in that phase we looked at 3 hard and 3 natural shorelines very broadly, trying to understand how they compare across a suite of ecological attributes—macro invertebrates, fish, plant communities, wave attenuation, and whole host of things.

The second part is funded under the NERRS Science Collaborative which is to look in much more detail at the engineered shorelines and to understand if there are simple design features, such as to vary the texture—how much to vary the texture, if you scallop the shoreline how much does that help. These are things we can manipulate.

Part of the most recent study is looking at fish preferences. We're learning what fish live near different kinds of shoreline.

Slide 36. Scientists have been looking at the dry side, or the intertidal shoreline, looking at craters and accumulated floating material lodging in the intertidal areas, and they're also looking at the other side. David Fisher is one of the researchers.

Slide 37 (43:50). Stuart Findlay who is also at Cary developed a rapid assessment protocol, so we didn't always have to go out and hire a team of ecologists to evaluate a part of the shoreline, He was developing a quick and dirty method so folks without ecological expertise could evaluate the ecological component of the shoreline in an hour or two. We've tested this with college students and are likely to deploy it as citizen science that can be spread more widely.

Slide 39 (44:32). Some of our study results are messy. The ecological characteristics vary widely. The different functions do not vary in parallel. All things are not maximized by one shoreline solution. We can explain some of that variation by shore type. Engineered shorelines tend to have poorer ecological function than "natural" shorelines. Some variation is explained by physical characteristics of the shore zone. That's one of the three ways we're looking at existing structures and how they compare.

Slide 40 (45:47). The other two ways are looking at structural stability and the cost of shoreline management options. Initially they were separate, but we realized we needed to tackle them together, especially due to cost of the study. Our target audience wasn't interested in that nuance. They wanted to know how much is it going to cost to build and maintain, and is it going to stand up.

Slide 41 (46:38). Jon Miller at Stevens did a shoreline review of literature, and this is a piece of it. The literature review looked at 25 different shoreline structures, and tried out one-way water flows and to come up with a suite of options that could be used in estuaries. They tried to rank it. The information is uneven, so it's hard to do this kind of comparison. Again, here's a resource we hope will be useful to some of you, to go onto our web site, pull this off and see what's known about gabions and revetments. It's much less technical than the Army Corps manual. We asked him to look at whether it was a hard or soft approach, ecologically good or bad, and

that being refined over time with what we're learning in terms of ecology. He and his student Andrew Geller tried to assess construction costs, very broadly speaking, trying to ballpark costs because these costs are very site specific. And adaptability was a guesstimate in terms of how might it stand up through the century. Blkhds ranked low in adaptability. They would need to be replaced, in contrast to something like riprap which is very adaptable, because you can continue to add more stone in the upper end.

Going to the next slide, based on that, we looked at a subset of ten of those treatments, most appropriate to the Hudson estuary. We asked him to project the cost of those – both construction cost and maintenance cost – through time up to 2080, over that 70-year period, factoring in two types of sea level rise, and imposing some artificial conditions, like storms. We made these cost estimates based on 3 actual sites with very different characteristics. One gradual, one steeper, and one very hard and very deep. This work was completed this summer. The take home message of this work is that of the 10 treatments, 5 were conventional treatments, and 5 were ecologically enhanced.

Slide 43 (51:42). This slide shows what those treatments were. The big question our regulators asked us is whether they required the ecologically enhanced, what was the cost. Was it twice the cost, or was it reasonable for them to ask for those kinds of enhancements going forward. The answer is that they are generally cost-competitive.

Any of these pieces could be a webinar in and of themselves—how this was done, and the assumptions that he used doing this assessment. We showcased this at our AC meeting earlier this month. People were intrigued by it and were accepting of it. This may be something we try to carry out to people, trying to decide how technical a translation we can do with this. Different for an engineering audience vs a municipal official audience.

Slide 44 (53:44). Findings on structural stability and cost of different shoreline options. Even very hard vertical shorelines can be enhanced ecologically. The costs were very similar on our three sites. It opens the door for us to recommend these, as they're not cost prohibitive.

Those are the two groups of findings I wanted to talk about today: the physical setting descriptions, present and future, and then how can we better understand the treatments that are available.

(54:40) I'll pause now for questions about those findings.
Dolores: It's amazing that Betsy and Ona have been able to distill this very complicated project down to this presentation. Kudos.

Questions about the physical conditions study or one of the ecological studies Betsy talked about?

Kalle: Can you tell us more about green or bio-walls? What they look like and how they might function to be better than a blkhd.

Betsy: A bio-wall is a broad term. The range of possibilities are walls that have niches set in for vegetation to grow for a lot of physical structure instead of a very smooth surface, or even a crenulated surface, as they often are, a vertical line going up and down, not completely flat, they have a little bit of structure. But compare that to something that has 6-8" rock imbedded in it, a cement wall where things can actually live. Compare that to the image I showed in the beginning – soft and hard – that has multiple vegetations planted in the bottom. One of the things we expect to experiment with are organic debris catchers. Everything there, to hanging planters. The sky's the limit for what you could conceive to do in a bio-wall, and make it more biologically active. It's not just plants, it's macro-invertebrates, all the way down to smaller invertebrates, larger fish. You can imagine a bio-wall being a place that creates resting places for fish, or a scalloped shoreline, with planned use, with slightly lower energy areas that fish could rest in, that they might not be able to in a high current area.
Kalle: Thank you, Betsy.

(58:20) Jaime: I was wondering if you have produced a series of maps that show some of these areas that you discussed. I was thinking of how your end users might benefit from this, and since you're able to give them advice about hard structures, depending on what their local circumstances are, I was visualizing from my cell phone a map of the shorelines, saying in these

places you could do thus and so, but maybe it's too site specific to do that kind of mapping, but I was curious about that and about maps in general.

Betsy: We have maps now of what the current shoreline looks like. We have maps of what the ice cover is. We have maps emerging of the current structure. We've had a recent conversation about how we can aggregate this information to create a simpler tool for people. If you were at this point right here, your options, given the physical conditions, are a, b, f, and j. We're still exploring whether that's possible. Another idea emerged from that conversation that's intriguing that came from Dave Strayer, to create an expert system key. It's not like a traditional dichotomous key. You could input a lot of information describing your shoreline, then you can pose the question of what kind of treatment might be appropriate, and it can give you some options. If you're not sure how to answer, it can provide you with pictures to help determine what fits your site. My point is that there are novel tools that we're actively considering to make information most accessible for our different audiences. We're expecting a wide range of tools for people with different technical levels. So we will have maps of different conditions along the Hudson, but we're still testing that theory.

(1:02:00) Dolores: With a project with so many complex components, with information that needs to be translated for so many different audiences, how do you handle the "intended user fatigue"? All the folks you're checking in with through the duration of this project to help guide the science and help shape the tools, do you find some people say, 'enough is enough'?

Betsy: You mean the intended users get fatigued or we get tired of dealing with them all?
Dolores: How about both?
Betsy: I don't feel that we have intended user fatigue. It's too interesting to try to figure out how we're going to get them to change their behaviors, and meet their needs. It's a challenge. Because we appear to generate some things they're interested in, they're willing to engage with us, it's fun. It's very hard, but I wouldn't use the word 'fatigue' in conjunction with it. Ona?

(1:03:53) Ona: I don't think we ask a lot of our AC members at different times, but we know that some of them can only attend the meetings once or twice a year. We've started doing what I learned from the Ohio Science Collaborative stormwater project, where we're sending out occasional updates that are one page documents. They're straightforward with us about what they can and can't do or when they do or don't have time to help us out on things. We try to ask that directly. In terms of our fatigue, I think it's not too much engagement, it's remembering everything we learned over years of everyone's professional experience previous to the project, and then the last three years. We've had many different meetings with many different groups, heard lots of good advice and guidance, and it's not getting caught up in research detail, but remembering we have five different user audiences and trying to remember for a particular piece of research which intended users are going to get this research and in what form. It's simplifying and remembering a lot of decisions are site specific, and we're probably not going to be able to create one product that's going to meet everyone's needs, but a lot of things people can apply and will trigger people's thinking in many different contexts.

No more questions. On to the final part of the presentation.

Ona: I'm going to talk about things we didn't know at the beginning, but four things we learned over the last few years, which are questions from our intended audiences about how relevant things are.

Slide 48. Lesson 1. Will it work here? We know it worked in other places, we want to know how it will work in Hudson conditions, not theoretically, but for real.

Slide 49. The image in blue is the demonstration site. We are committed to bringing improved shoreline sites to the Hudson. This is the Coxsackie Boat Launch where there was erosion threatening the parking lot.

Slide 50. This is the site our coordinating team members Dan Miller from the Reserve and Jon Miller from the Stevens Institute helped to design. They met numerous times with the site owners and talked with them about their needs for the site, and tried to design something that would maintain

the integrity of the site and the landmass, preventing erosion, while having an ecological benefit. This photo was from February. There is a newer photo with new growth showing.

Slide 51: There is also going to be a demonstration site network, which will be an online resource of sites up and down the Hudson that we consider ecologically enhanced. It will tell people how to get to those sites, tell them about the design process, case studies, photographs, and contacts, and design documents, so people can learn what's being used here already, how things are performing, and contact the people who are involved if they want to learn more directly. And there would be a map. On the left is Esopus Meadows Preserve shoreline before, and on the right how it looks now. That's a project by Scenic Hudson, an environmental group we are working with. That was the Will It Work Here question and one of the ways we're addressing that.

Slide 52: Lesson 2. When should the subject be raised? We need to get these ideas about enhanced shorelines to people early on in their planning. In NY State there's the Local Waterfront Revitalization Program for municipalities that do master planning for their shore zone. We need to get ideas that would have more ecological value to them before, or as they're doing, that planning process and putting it into local legislation, and not at the time when the project has been engineered, designed and developed, and is going for permitting and approval.

Slide 53: Lesson 3. Where should shoreline treatments go? This is a photo of Kingston, N.Y. This is something that our team learned from the demonstration site at Coxsackie. Dan Miller is the one who really distilled this issue for us.

Slide 54: Ecologically enhanced shoreline—where does it go? State and federal regulations prevent things from being built out into the area below the high tide (vertical orange line). On the right of the vertical orange line the landowners want to maintain as much of their land as possible. They don't want to cut back and let the water come in more. So these two different groups who are trying to reach agreement on what can happen on the shoreline pushes for vertically. It maximizes the interest for both

groups. We're trying to raise the question in the state if there is a way of how to split the difference. Is it possible for something to be approved that goes out into the water below the high tide mark, and could you do that with land as well.

Lesson 4. (1:12:34) How can we share what we've learned? We were talking about mapping in Betsy's segment. We are also producing synthesis summary documents for every piece of research we do, so a layperson can read the executive summary. We're finding that direct technical assistance is something we didn't know we'd be asked to do, but as it's so site specific, it might be one of the best ways to get these ideas out. I'm talking with people and helping them ask the right questions. As a decision tool, we're thinking we'll probably produce something that takes people through a series of questions that we think are good to ask when deciding on a shoreline treatment. We're not sure what form that will take yet. We are going to be doing various presentations, trainings, and meetings—some public, and some less public—about what we're learning and how we think that should be impacting what is allowed to happen, what happens, what could happen. That's a quick synthesis of some of our key things that we've found as we move forward that have altered what we're doing.

(1:14:04) Any questions?

Dolores: We had planned to have surveys throughout the webinar, and get your bead on particular issues. If you have questions or ideas for Ona or Betsy please feel free to share them, or if you have thoughts about a future webinar or another teleconference where we can dig into a topic, and you want to let us know at the Science Collaborative, that would be great. I noted at registration at least half of you on the call are working on some kind of sustainable shorelines project. If you have something you want to share, please feel free to do that.

Some of our best suggestions have come from you. We'd like to hear your thought, reactions and ideas.

Jaime: Technical assistance was something you said you had not anticipated. I wondered how you were able to respond to that need in

terms of how you juggled staff time at the Reserve or the partners, where you could have served as a conduit for the technical assistance.

Betsy: Dan Miller is the habitat restoration coordinator for the Hudson River Estuary Program. We all work closely together. People call us and ask if we can come out and take a look. That has led to a series of incipient demonstration projects. That seems to be accelerating. I don't know how much longer we'll be able to meet that capacity, but that's how we've done it.

Ona: We're also investigating the possibility of someone partnering at the Army Corps of Engineers who has related knowledge and has time and willingness to provide technical assistance. We're looking for other partnerships as well.

Betsy: And we're trying to build capacity among the larger group of partners who are focused on revitalizing waterfronts and helping communities adapt to climate change. We're trying to make sure the shoreline piece is truly integrated into their work, and that's happening with outreach in six different settings right now, so that we're not the only ones carrying this message.

Any other questions?
Rebecca Ellin from N.C.: Really enjoyed the presentation. A comment: We're wrapping up a CICEET project and our state is putting together a long-range implementation plan for estuarine shorelines that is a multi-organizational effort and we've been trying to answer the question of where do we want to go from here, building on the CICEET work we've done. The presentation provided enough helpful examples for taking the work we're doing here to the next step, and I've made note of those resources. So I wanted to say thank you in advance for sharing all of those.

Betsy: As our regulations are being revised in New York State, we're finding that we can tweak them, so we're trying to get very involved in the reg tweaking that's happening. Also opportunistically, we became aware, partly through the regulatory work that I do, which is a little part of my job, that there are huge opportunities. So I wanted to put it out there that if anyone

is interested in that, I'd love to talk to you. We're trying to change how business is done around remediation, given a lot of these shoreline sites will be inundated.

Dolores: Thank you, everyone, for your time today. Thanks especially to Betsy and Ona for putting this interesting presentation together. Please send me an email or give me a call if you're interested in learning a little more about a component of this project, and we'll see what we can do to support that exchange of information.

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